[0047] Additionally, the present system may be able to detect up to one, two, five, or ten individual finger positions depending on its capability. According to one exemplary embodiment, each finger detected will have the reference of the $n^{th}$ index. **FIG. 1D** illustrates coordinates 6 and 7 when two fingers were detected according to one exemplary embodiment. As shown in **FIG. 1D**, the two fingers would have (n) values equal to 1 and 2 respectively, and would be referenced as $(X, Y)_1$ and $(X, Y)_2$.

[0048] Additionally, the messages received by the computerized systems from the present touch-sensing device are the absolute position (a point, or a coordinate) of each sensing finger $(X, Y)_n$ relative to its absolute origin, approximated area or pressure value of each sensing finger $(Z)_n$, $(\text{Delta } X)_n$—amount of each horizontal finger motion, $(\text{Delta } Y)_n$—amount of each vertical finger motion. All this information can be used to calculate additional information such as speed, acceleration, displacement, etc. as needed by a computer.

[0049] The system also allows each finger to make a selection or an input by pressing the finger on the sensing surface. This signal is assigned as $(S)_n$—state of virtual button being selected at location $(X,Y)_n$, 0=not pressed, 1=pressed. In fact, $(S)_n$ could be derived by setting a threshold number for the $(Z)_n$, if no proprietary mechanism was installed. According to this exemplary embodiment, an input device incorporating the present system and method will provide the sensation of pressing a button such as surface indentation when $(S)_n=1$. This mechanism is also known as a virtual switch or virtual button.

[0050] **FIG. 2** illustrates an example of a virtual button surface **(9)** in a perspective view using an air gap or a spacer **(10)** according to one exemplary embodiment. When a finger **(4)** presses on the surface **(9)**, an indentation is created around the finger **(4)**, giving the sensation of pressing a switch. The contact point **(11)** can be calculated by measuring voltage changes between the two layers, though it is not necessary if the device can recognize a $(Z)_n$ value.

[0051] An alternative method that may be used to create the virtual switch feature is illustrated in **FIG. 3A** by using a rubber feet layer in place of the air gap. According to the exemplary embodiment illustrated in **FIG. 3A**, the finger **(4)** is resting on the surface **(12)**. Located beneath the surface **(12)** is a rubber feet layer **(13)**. **FIG. 3B** illustrates the pressing of the embodiment illustrated in **FIG. 3A**. The indentation area **(14)** caused by the pressing may be a round, square, hexagon, or any other form depending on the layout of the rubber feet **(13)**. **FIG. 4A** illustrates a perspective view of the touch sensing surface illustrated in **FIG. 3A**. The top layer **(15)** of the touch sensing surface is transparent, thereby facilitating a view of the square shape rubber feet layer **(13)**. **FIG. 4B** shows that if the top layer **(15)** is pressed with a finger or other object, the indentation on the surface will be a square shape **(14)** according to the rubber feet feature.

[0052] The air gap and rubber feet techniques illustrated above are suitable for a multi-input sensing surface, because they allow each individual finger to make an input decision simultaneously. However, for a single-input sensing device having a hard surface, such as a touch pad for instance, there is no need to worry about input confusion. A virtual switch mechanism can be added to a touch pad by installing a physical switch underneath. **FIG. 5** illustrates one exemplary embodiment of a touch pad having a virtual switch mechanism. As shown in **FIG. 5**, four switches **(18)**, connected electrically in parallel, are located below each corner of a touch pad. According to the schematic drawing illustrated in **FIG. 5**, the insulator surface **(16)** of the touch pad configured to protect a user's finger from the analog grid layer **(17)** can detect a finger position. Additionally, four switches **(18)** are coupled in parallel behind four corners of the touch pad. All electrical signals sensed by the analog grid layer **(17)** will be sent to a micro-controller **(19)** to interpret raw signals and send signal interpretations and commands to a communicatively coupled computerized system **(20)**.

[0053] According to one exemplary embodiment, the present system and method is configured to detect both an operator's left and right hand positions along with their individual fingertip positions. This exemplary system and method designates the individual hand and fingertip positions by including an extra indicator in the finger identifiers—(R) for right hand and (L) for left hand, ie. $(X, Y)_{nR}$. The convention setting can be (R=1) for fingers corresponding to the right hand, and (R=0) for the left hand. By detecting both an operator's left and right hand positions as well as associated finger positions and hovering hands above the sensing surface, additional information may be gathered that will help in better rejecting inputs caused by palm detections.

[0054] According to one exemplary embodiment, input devices may be prepared, as indicated above, to detect a single finger or multiple fingers. These input devices may include a customized touchpad or multi-touch sensors. Additionally, multiple element sensors can be installed on any number of input devices as needed for more accurate positioning. Implementation and operation of the present input devices will be further described below.

[0055] Active Space Interaction Method

[0056] Active space interactive method is a system and a method that allows software to interpret a current active area (e.g. an active window, an active menu) and map all the active buttons or objects in this active area onto an associated sensing surface. According to one exemplary embodiment, once the active buttons have been mapped, the operator will be able to select and/or control the options on the screen as if the screen were presently before them. **FIG. 6A** illustrates a display screen **(21)** of a mobile telephone which is considered as an active area according to one exemplary embodiment. The graphic **(22)** portion of the cell phone is a non-active object, because the operator cannot make any manipulation on it. However, the other graphics **(23, 24, and 25)**, which are buttons 'DEL', '>', and '*' respectively, are active graphics. As active graphics, the above-mentioned buttons can be selected by an operator. So that they may be accessed by a user, the active graphics **(23, 24, and 25)** are mapped on the sensing surface **(1)** of **FIG. 6B**. As shown in **FIG. 6B**, prior to the detection of a finger, the active graphics **(23, 24, and 25; FIG. 6A)** are mapped to designated areas on the sensing surface **(1)**. The dotted line **(27)** illustrated in **FIG. 6B** represents an imaginary line that separates the active graphics. By way of example, the block **(26)** represents a space designated for the 'DEL' button and block **(28)** represents a numerical '8' button.

[0057] **FIG. 6C** illustrates the operation of the active space system. As shown in **FIG. 6C**, when a finger **(4)** is